

1 **Amendment to the Claims**

2 In the Claims:

3 Please cancel Claims 71-76, as noted below.

4 Please also amend Claims 1, 3, 4, 5, 11, 12, 13, 16, and 17, and add new Claims 78-80, as  
5 follows:

6 1. (Currently Amended) A modular system for producing a chemical product from a  
7 plurality of reactants comprising:

8 (a) a control module, said control module being adapted to monitor and control  
9 production of the chemical product by the modular system, said control module comprising a  
10 processor, a reaction database, and a user interface, the control module being configured to enable a  
11 user to interact with the user interface to select a specific reaction to produce the chemical product,  
12 from a plurality of different reactions stored in the reaction database, so that in response to a selection  
13 made by a user, the processor automatically controls the modular system to produce the chemical  
14 product according to reaction parameters for the specific reaction that was selected, said reaction  
15 parameters being stored in the reaction database;

16 (b) a reactant supply source for each of said plurality of reactants, a flow of each  
17 reactant from its reactant supply source being controlled by the control module; and

18 (c) a first reaction module in fluid communication with each reactant supply source to  
19 receive each of the plurality of reactants, said first reaction module being controllably connected to said  
20 control module and including a reactor, said reactor automatically producing the chemical product from  
21 said plurality of reactants under the control of the control module, said reactor comprising a plurality of  
22 simple ~~plate stacked~~ plates stacked in layers, each simple plate having at least one opening that extends  
23 therethrough, an opening in each simple plate overlapping at least one other opening in an adjacent simple  
24 plate, thereby forming at least one passage within ~~the apparatus~~ said reactor for each of said plurality of  
25 reactants, ~~such passages~~ each at least one passage for each of said plurality of reactants merging within  
26 ~~the apparatus~~ said reactor to form a at least one reaction chamber, the chemical product being formed  
27 within said at least one reaction chamber by a reaction between said plurality of reactants, the plurality of  
28 simple plates including plates of different thicknesses, such that each simple plate disposed at an  
29 uppermost layer and at a lowermost layer in ~~the apparatus~~ said reactor is substantially thicker than each  
30 simple plate disposed between the uppermost layer and the lowermost layer; and

1           (d) a pump module controllably connected to the control module, said pump  
2 module being in fluid communication with each reactant supply source and with said first reaction  
3 module, the pump module pumping a plurality of fluids through the modular system, the pump  
4 module comprising a housing enclosing:

5                   (i) a first reactant pump;  
6                   (ii) a second reactant pump;  
7                   (iii) a heat transfer media pump;  
8                   (iv) a data and power bus;  
9                   (v) a first valve configured to selectively couple the first reactant pump in  
10 fluid communication with a solvent supply and a first reactant supply; and

11                   (vi) a second valve configured to selectively couple the second reactant  
12 pump in fluid communication with the solvent supply and a second reactant supply.

13           2. (Previously Presented) The modular system of Claim 1, wherein said reactor is  
14 replaceable, and comprises at least one mixing volume.

15           3. (Currently Amended) The modular system of ~~Claim 1~~ Claim 77, wherein at least one  
16 reactant supply source and said first reaction module are configured to accommodate a reactant that is  
17 in a gaseous state.

18           4. (Currently Amended) The modular system of ~~Claim 1~~ Claim 77, further comprising a  
19 pump module controllably connected to the control module, said pump module being in fluid  
20 communication with each reactant supply source and with said first reaction module, the pump  
21 module pumping a plurality of fluids through the modular system, the pump module comprising a  
22 housing enclosing:

23                   (a) a first reactant pump;  
24                   (b) a second reactant pump;  
25                   (c) a heat transfer media pump;  
26                   (d) a data and power bus;  
27                   (e) a first valve configured to selectively couple the first reactant pump in fluid  
28 communication with a solvent supply and a first reactant supply; and  
29                   (f) a second valve configured to selectively couple the second reactant pump in  
30 fluid communication with the solvent supply and a second reactant supply.

1           5. (Currently Amended) The modular system of ~~Claim 1~~ Claim 77, further comprising an  
2 additional processing module in fluid communication with said first reaction module, said additional  
3 processing module being disposed downstream of said reactor, such that the chemical product  
4 produced in the reactor passes through said additional processing module.

5           6. (Previously Presented) The modular system of Claim 5, wherein said additional  
6 processing module comprises a residence time module in which reaction of the chemical product  
7 continues toward completion for a predetermined amount of time.

8           7. (Previously Presented) The modular system of Claim 6, wherein said residence time  
9 module comprises a capillary passage of a length selected to obtain the predetermined amount of time  
10 for said chemical product in said residence time module.

11           8. (Original) The modular system of Claim 6, wherein said residence time module comprises  
12 a proportional valve, said proportional valve being controllably connected to said control module to  
13 selectively vary a pressure within said modular system.

14           9. (Previously Presented) The modular system of Claim 5, wherein said additional  
15 processing module comprises a second reaction module in fluid communication with said first  
16 reaction module, such that a serial fluid path is created with respect to said first reaction module, said  
17 second reaction module being controllably connected to said control module and including a reactor  
18 that produces the chemical product from a reaction of said plurality of reactants using a plurality of  
19 synthesis steps, a first synthesis step being completed in said first reaction module, and a second  
20 synthesis step being completed in said second reaction module.

21           10. (Previously Presented) The modular system of Claim 9, further comprising sufficient  
22 additional processing modules, each additional processing module including a reaction module, so  
23 that production of the chemical product can be achieved using additional synthesis steps that are  
24 completed in succession, each additional synthesis step being completed in a different one of the  
25 additional processing modules, the reaction module in each additional processing module being  
26 configured to receive a product from a previous additional processing module in which an  
27 immediately preceding synthesis step was completed.

28           11. (Currently Amended) The modular system of Claim 1, wherein said reactor is  
29 specifically configured to enable it to produce a class of chemical products, and is selectively readily  
30 removable from said first reaction module and ~~replacable~~ replaceable with a different reactor

1 configured to facilitate the production of a different class of chemical products, thus enabling said  
2 modular system to selectively produce different classes of chemical products.

3 12. (Currently Amended) The modular system of Claim 5, wherein said housing of the first  
4 reaction module ~~further includes a housing, said housing comprising comprises:~~

5 (a) a first side that includes a plurality of ports enabling said first reaction module  
6 to be removably connected to said control module and in fluid communication with said each reactant  
7 supply; and

8 (b) a second side that includes a plurality of ports enabling said first reaction  
9 module to be in fluid communication with at least one of the additional processing module and a  
10 product reservoir; ~~and~~

11 (c) ~~a mounting frame for said reactor, said mounting frame being enclosed within~~  
12 ~~said housing, and being configured to apply a biasing force to secure said reactor in position.~~

13 13. (Currently Amended) The modular system of ~~Claim 1~~ Claim 77, wherein said first  
14 reaction module comprises means for facilitating production of said chemical product.

15 14. (Original) The modular system of Claim 13, wherein said means include at least one of a  
16 heat exchanger, a temperature sensor, and a reactant laminar flow mixing passage.

17 15. (Previously Canceled)

18 16. (Currently Amended) The modular system of ~~Claim 1~~ Claim 77, wherein said modular  
19 system further comprises ~~a plurality of fluid paths, including a fluid path for each of said plurality of~~  
20 ~~reactants, a fluid path for said chemical product,~~ at least one fluid path for a heat transfer media, and at  
21 least one fluid path for a spent heat transfer media.

22 17. (Currently Amended) The modular system of ~~Claim 1~~ Claim 16, wherein said at least  
23 one fluid path for said heat transfer media and said at least one fluid path for said spent heat transfer  
24 media are configured in a serial fluidic system.

25 18. (Previously Presented) The modular system of Claim 4, wherein each pump in the pump  
26 module is controllably connected to said control module to control operation of the pump.

27 19. - 21. (Previously Canceled)

28 22. (Previously Presented) The modular system of Claim 4, wherein said each valve in the  
29 pump module is controllably connected to said control module to control a flow of one of said  
30 plurality of reactants to said first reaction module.

1           23. (Previously Presented) The modular system of Claim 4, wherein said pump module  
2 comprises at least one filter that filters one of said plurality of reactants before the reactant flows to  
3 said first reaction module.

4           24. (Previously Presented) The modular system of Claim 4, wherein said housing comprises:  
5               (a) a first side that includes a plurality of ports enabling said pump module to be  
6 controllably connected to said control module, and to be in fluid communication with each reactant  
7 supply source; and

8               (b) a second side that includes a plurality of ports enabling said pump module to  
9 be in fluid communication with said first reaction module.

10          25. (Previously Canceled)

11          26. (Original) The modular system of Claim 4, wherein all connections between modules are  
12 achieved using quick connect connectors that enable rapid connection and disconnection of the modules.

13          27 - 70, (Previously Canceled)

14          71.-76. (Currently Canceled)

15          77. (Previously Presented) A modular system for producing a chemical product from a  
16 plurality of reactants comprising:

17               (a) a control module, said control module being adapted to monitor and control  
18 production of the chemical product by the modular system;

19               (b) a reactant supply source for each of said plurality of reactants, a flow of each  
20 reactant from its reactant supply source being controlled by the control module; and

21               (c) a first reaction module in fluid communication with each reactant supply  
22 source to receive each of the plurality of reactants, said first reaction module being controllably  
23 connected to said control module and comprising:

24                   (i) a housing;

25                   (ii) a mounting frame disposed within the housing, the mounting frame  
26 being configured to support a reactor, the mounting frame comprising a plurality of plates, at least  
27 one of which is fixed in position, and at least one of which is moveable, the at least one movable of  
28 the plurality of plates enabling the reactor to be removed from the mounting frame; and

29                   (iii) a replaceable reactor supported by the mounting frame, said replaceable  
30 reactor automatically producing the chemical product from said plurality of reactants under the

1 control of the control module, said replaceable reactor comprising a plurality of simple plates, the  
2 simple plates being configured such that aligned openings in the plurality of simple plates achieve at  
3 least two reactant fluid pathways, at least one mixing volume, at least one reaction volume, and at  
4 least one product fluid pathway.

5 78. (New) A modular system for producing a chemical product from a plurality of reactants  
6 comprising:

7 (a) a control module, said control module being adapted to monitor and control  
8 production of the chemical product by the modular system, said control module comprising a processor, a  
9 reaction database, and a user interface, the control module being configured to enable a user to interact  
10 with the user interface to select a specific reaction to produce the chemical product, from a plurality of  
11 different reactions stored in the reaction database, so that in response to a selection made by a user, the  
12 processor automatically controls the modular system to produce the chemical product according to  
13 reaction parameters for the specific reaction that was selected, said reaction parameters being stored in the  
14 reaction database;

15 (b) a reactant supply source for each of said plurality of reactants, a flow of each  
16 reactant from its reactant supply source being controlled by the control module; and

17 (c) a first reaction module in fluid communication with each reactant supply source to  
18 receive each of the plurality of reactants, said first reaction module being controllably connected to said  
19 control module and including a reactor, said reactor automatically producing the chemical product from  
20 said plurality of reactants under the control of the control module, said reactor comprising a plurality of  
21 simple plates stacked in layers, each simple plate having at least one opening that extends therethrough,  
22 an opening in each simple plate overlapping at least one other opening in an adjacent simple plate,  
23 thereby forming at least one passage within said reactor for each of said plurality of reactants, each at least  
24 one passage for each of said plurality of reactants merging within said reactor to form at least one reaction  
25 chamber, the chemical product being formed within said at least one reaction chamber by a reaction  
26 between said plurality of reactants, the plurality of simple plates including plates of different thicknesses,  
27 such that each simple plate disposed at an uppermost layer and at a lowermost layer in said reactor is  
28 substantially thicker than each simple plate disposed between the uppermost layer and the lowermost  
29 layer; and

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1 (d) an additional processing module in fluid communication with said first reaction  
2 module, said additional processing module being disposed downstream of said reactor, such that the  
3 chemical product produced in the reactor passes through said additional processing module, said  
4 additional processing module comprising a residence time module in which reaction of the chemical  
5 product continues toward completion for a predetermined amount of time, said residence time module  
6 comprising a proportional valve, said proportional valve being controllably connected to said control  
7 module to selectively vary a pressure within said modular system.

8 79. (New) A modular system for producing a chemical product from a plurality of reactants  
9 comprising:

10 (a) a control module, said control module being adapted to monitor and control  
11 production of the chemical product by the modular system, said control module comprising a processor, a  
12 reaction database, and a user interface, the control module being configured to enable a user to interact  
13 with the user interface to select a specific reaction to produce the chemical product, from a plurality of  
14 different reactions stored in the reaction database, so that in response to a selection made by a user, the  
15 processor automatically controls the modular system to produce the chemical product according to  
16 reaction parameters for the specific reaction that was selected, said reaction parameters being stored in the  
17 reaction database;

18 (b) a reactant supply source for each of said plurality of reactants, a flow of each  
19 reactant from its reactant supply source being controlled by the control module; and

20 (c) a first reaction module in fluid communication with each reactant supply source to  
21 receive each of the plurality of reactants, said first reaction module being controllably connected to said  
22 control module and including a reactor, said reactor automatically producing the chemical product from  
23 said plurality of reactants under the control of the control module, said reactor comprising a plurality of  
24 simple plates stacked in layers, each simple plate having at least one opening that extends therethrough,  
25 an opening in each simple plate overlapping at least one other opening in an adjacent simple plate,  
26 thereby forming at least one passage within said reactor for each of said plurality of reactants, each at least  
27 one passage for each of said plurality of reactants merging within said reactor to form at least one reaction  
28 chamber, the chemical product being formed within said at least one reaction chamber by a reaction  
29 between said plurality of reactants, the plurality of simple plates including plates of different thicknesses,  
30 such that each simple plate disposed at an uppermost layer and at a lowermost layer in said reactor is

1 substantially thicker than each simple plate disposed between the uppermost layer and the lowermost  
2 layer; said first reaction module further including a housing, said housing comprising:

3 (i) a first side that includes a plurality of ports enabling said first reaction module to  
4 be removably connected to said control module and in fluid communication with said each reactant  
5 supply;

6 (ii) a second side that includes a plurality of ports enabling said first reaction module  
7 to be in fluid communication with at least one of an additional processing module and a product reservoir;  
8 and

9 (iii) a mounting frame for said reactor, said mounting frame being enclosed within said  
10 housing, and being configured to apply a biasing force to secure said reactor in position; and

11 (d) an additional processing module in fluid communication with said first reaction  
12 module, said additional processing module being disposed downstream of said reactor, such that the  
13 chemical product produced in the reactor passes through said additional processing module.

14 80. (New) A modular system for producing a chemical product from a plurality of reactants  
15 comprising:

16 (a) a control module, said control module being adapted to monitor and control  
17 production of the chemical product by the modular system;

18 (b) a reactant supply source for each of said plurality of reactants, a flow of each  
19 reactant from its reactant supply source being controlled by the control module; and

20 (c) a first reaction module in fluid communication with each reactant supply source to  
21 receive each of the plurality of reactants, said first reaction module being controllably connected to said  
22 control module and comprising:

23 (i) a housing;

24 (ii) a replaceable reactor, said replaceable reactor automatically producing the  
25 chemical product from said plurality of reactants under the control of the control module; and

26 (iii) a mounting frame disposed within the housing, the mounting frame being  
27 configured to support the replaceable reactor, the mounting frame comprising a plurality of plates, at least  
28 one of which is fixed in position, and at least one of which is moveable, the at least one of the plurality of  
29 plates that is movable enabling the replaceable reactor to be removed from the mounting frame.

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